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## GEOLOGY OF SOUTHERN INDIA.

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THE following Notes have been received from Captain Newbold since the printing of the earlier pages.

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NOTE TO PAPER ON DIAMOND SANDSTONE AND LIMESTONE  
(pp. 156—171).

THE following note is from Mr. Piddington on a mineral recently discovered by Captain Newbold in the shales of the limestone of Gazopilly Eastern Gháts, associated with galena, quartz, calcspar, and sulphate of barytes:

“I have the pleasure of informing you that your red mineral is, as you supposed, an ore of cerium; and moreover, of that most rare kind, carbonate of cerium. It contains iron, lead, lime, *silex*, alumina, and perhaps, yttria and magnesia.”

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ADDITIONAL NOTE TO PAPER ON TRICHINOPOLY FOSSILIFEROUS  
LIMESTONE (p. 218).

SINCE my first paper on the Trichinopoly fossiliferous limestone, Captain Lawford, of the Madras Engineers, has kindly examined for me, more accurately, the limits and geological relations of these beds, and I have much pleasure in forwarding the following abstract of the notes he sent me, as a valuable *addendum* to the paper alluded to, with a few brief remarks of my own.

It will be right to premise that these notes commence at the N.E. extremity of these beds, following the strike of their stratification in a S.W. direction from the south bank of the Vellaur towards the valley of the Coleroon.

*Keranoor, Olapaudy, and Varagoor.*—Proceeding easterly along the right bank of the Vellaur from Keranoor, a tappal station on the Madras road about forty miles road distance N.N.E. from Trichinopoly and Vudakuloor, where a deep black soil covers the rocks, hornblende schist is the first rock seen, and hornblende rock in loose rounded blocks; they occur a little to the south of the Chennaur, a tributary to the Vellaur. The hornblende schist is in nearly vertical strata running east and west, and forms the base of a gentle acclivity in which were first seen the beds of fossiliferous limestone,

which is found about four feet below the surface. The upper soil is a light brown mould containing much kunker, which also encrusts the limestone. The dip of the latter is towards the south, at an angle of ten degrees; the thickness of the beds could not be measured, but the height of the ground may be about one hundred feet above the stream. Proceeding south-east from Olapady, Captain Lawford passed along the western base of this acclivity, and still observed the hornblende as the underlying rock. In some quarries in the limestone, from which blocks nine feet by two and two feet and a half were being cut, the stratification was very distinct: dip and direction as before. Three feet below the surface was a layer of limestone with fossils nine inches thick, overlying a layer three or four feet thick of friable calcareous earth (marl), in which no fossils were observed, and which intervened between the upper and lower or main fossiliferous beds; immediately below the latter was the hornblende. About a mile farther the ground declined gradually to the south, and the soil became black alluvium. Three miles farther small rounded blocks of hornblende were seen: and at Varagoor, where the Olapady high ground terminates, were some rounded blocks of the fossiliferous limestone embedded in kunker in the bed of a stream.

*From Varagoor to Shantanoor.*—From Varagoor to the S.E. much hornblende rock was observed; and at three miles' distance, on another rising ground, the black limestone embedding great quantities of shells was met with. Black soil and hornblende rock succeeded as far as the bed of a stream, where rounded blocks of the fossiliferous limestone were found embedded in sandstone. Dark alluvial soil continued to Shantanoor.

*Garoodamungalum ridge.*—From Shantanoor the country continued of the same character as before. At five miles the fossiliferous rocks were observed in the bed of a stream: dip and direction as before. A fossil nautilus was found here. From this stream the ground rises to the S.E., and a ridge of fossiliferous rocks runs due north and south as far as the eye can reach. They formed the eastern slopes of the acclivity, on the top of which stands Garoodamungalum, on a sort of plateau, the western slope of which consists of a ridge of rocks, parallel and similar to the one above mentioned. This plateau and the ridges of rock were described to Captain Lawford as extending about five miles to the south and as many north. The rocks are a blue fossiliferous limestone: dip and direction as before, soil reddish brown.

*To Pervullapoor.*—Continuing south, hornblende rock and the limestone were seen occasionally; but the fossils gradually disappeared,

and the last limestone noticed was at Pervullapoor, where it is yellow, schistose, and without fossils.

*South base of the Fossil Tract and Valley of the Coleroon.*—Beyond this, trap (basaltic greenstone) and quartz prevailed, and in another high ridge running east and west, overlooking the Coleroon, gneiss and granito. The great valley of the Coleroon and Cauvery, watered by numerous divisions of those rivers, is covered with a rich alluvium, which probably has its basis on the granito and hypogene rocks. Granito is seen on the opposite bank near Trichinopoly, occasionally overlaid by laterite, and occurs in the rock-islands in the river bed.

*Western flank of the Fossil Tract.*—At the western base of these fossiliferous ridges, along the line of Madras road, from the alluvium of the Coleroon on the south, to Keranoor on the Vellaur (whence we started) on the north, granito is seen between the Coleroon and Samiavoram. The soil is red, with much quartz and occasional rounded blocks of trap; between Samiavoram and Siriganoor, black cotton soil appears covered with much loose stone, chiefly trap and quartz; beyond the last place is a plain of deep cotton soil, succeeded by soil containing much kunker and loose trap.

About Ootatoor the rock is exclusively hornblende, rounded blocks of which literally cover the ground and form small eminences; hence to Toramungalum hornblende is the only rock visible, with abundance of kunker; the soil chiefly black alluvial. The same continues to near Volconda, where a calcareous schist is observed, and also magnesite; the latter in loose nodules and masses embedded in the soil; hornblende prevails also. The schist has a direction N.E. and S.W.: dip about twenty degrees. From Runjanguddy to the Chennai, near which we started, hornblende rock continues with much kunker, and is seen in the bed of the stream; thence to the Vellaur, a plain of deep black soil extends, above which little rock is visible.

Such is the drift of Captain Lawford's notes on these interesting and partially explored deposits, which have been now traced so far south as the north edge of the Coleroon valley. It will be seen that if a line be drawn from this S.W. point at Pervullapoor, through the major axis of these deposits, it will pass in a N.E. direction through or very near to those of Verdachellum and Pondicherry, comprising a direct distance N.E. of about one hundred miles. On referring to the Map we shall find that the larger gaps which now separate these deposits, are occupied by the valleys through which flow the principal rivers of this part of India to the Bay of Bengal, viz., the Panaur and Vellaur. Whether the valley of the Coleroon separates the Trichinopoly deposits from others still further to the south or S.W. at

intervals to Cape Comorin, remains still to be shown, or whether they here terminate or have been swept off by denudation. It seems probable, that though there may be differences in the ages of the fossiliferous strata, they once formed a continuous ridge, or parallel ridges, elevated gradually with the land from the bed of the sea to the different conditions of a sea beach, and subsequently of a coast ridge, and that the gaps we now see in their continuity, inexplicable by the supposition of the eroding powers of present streams, were formerly the sea embouchures of ancient lines of drainage, the directions of which have since but little changed.

The present height of the fossil beds above the Coleroon Captain Lawford states to be about two hundred feet, and that the surface of its area is undulating. The unconformable and smaller amount of dip relatively to that of the hypogene rocks on which they immediately rest, shows that the former had suffered great disturbance prior to the deposition of the limestone: but it is evident that the latter has partaken of the later disturbances which have affected the hypogene rocks, and lastly has been raised with them from the ocean's bed.

Fossils collected from the upper layer, described by Captain Lawford as separated by a non-fossiliferous stratum from the lower beds, should be kept distinct, as it is possible they belong to distinct epochs.

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